METHOD AND DEVICE FOR MACHINING EDGE REGIONS OF CYLINDRICAL HOLLOW BODIES

BACKGROUND AND SUMMARY OF THE INVENTION

[0001] The present invention relates to a method of producing radially inward-protruding projections or walls on the interior side of tooth tips constructed essentially axially with respect to the longitudinal axis on the envelope surface of an essentially cylindrical hollow body in the area of the front edge of the hollow body, and to a device for implementing the method having a working stamp which may be radially applied to the exterior surface of the tooth tip.

[0002] Cylindrical cup-shaped hollow bodies, whose outer surface has a regular structure, such as, particularly a toothing, are conventionally produced, for example, by mechanical processes, such as rolling, hammering or pressing.

[0003] As a rule, a reworking of the open or free edge region of such hollow bodies is required. As a rule, this takes place by the use of separate processing machines connected on the output side.

[0004] Specifically, in the case of profiled cup-shaped hollow bodies to be used in automatic transmissions as clutch plate carriers, the problem often occurs that, on the interior wall of the hollow body, in the area of the tooth tips, a wall is to be formed which projects toward the interior. In comparison to the wall thickness of the hollow body, this wall has very small dimensions.

[0005] A conventional method for producing such walls provides that, by use of a suitable tool, in an additional working step, a pressing operation is carried out in the axial direction of the hollow body on its edge. As a result, such a small wall is constructed in the area of the tip of the tooth. However, this method has the disadvantage that the wall cannot be manufactured with precise dimensions, and, as a result of the pressing motion, also the geometry of the hollow body in the edge region is at least slightly changed because an upsetting effect not only take place at the desired site, that is, the interior side of the tooth tip, but occurs over the entire region of the face of the hollow body.

[0006] Furthermore, a method is known in which a striking motion is carried out radially from the outside in each case individually onto the exterior side of each tooth tip in the edge region. This striking motion results in a displacement of material of the tooth tip radially from the outside toward the inside and, thereby, in the formation of a wall on the interior side of the tooth tip. However, this method also has the disadvantage of changing the geometry of the tooth tip.

[0007] It was an object of the present invention to find a method of producing such walls on the interior side of tooth tips of a hollow body, which does not change the geometry of the outer contour of the tooth tip, particularly in the area of the tooth profiles. According to the invention, this object is achieved by providing a method, wherein from outside radially toward the hollow-body axis, striking or stamping processes are carried out upon the exterior side of the tooth tip in the area of the front edge. The striking or stamping operations in each

case are carried out on a tooth tip only over a part of the width of the respective tooth tip.

[0008] Additional preferred embodiments of the present invention are described and claimed herein.

[0009] By carrying out striking or stamping processes on only a partial area of the width of the individual tooth tips, the change of the shaping of the respective tooth tip is advantageously prevented and a wall is nevertheless produced on the interior side of the tooth tip.

[0010] Preferably, the intensity of the striking or stamping process is adjusted such that, in each case, a wall having the desired dimension, that is, particularly the required radial dimension, is produced by way of a single stroke.

[0011] The wall is advantageously constructed to extend over the entire width of the interior surface of the tooth tip if the corresponding tool itself in each case corresponds to this width, that is, has a corresponding effective area.

[0012] So that, particularly in the case of thin wall thicknesses, no impairment of the tooth profiles of the tooth tip can take place, it is preferable to cause clamps to come to strike against the tooth profiles or the lateral tooth tip edges before or during the striking or stamping process. This reliably prevents a yielding of material in this direction and only a displacement of material takes place in the direction and for the formation of the wall. In this case, the clamp may be moved either separately of the striking or stamping tool or may be fixedly connected thereto.

[0013] The method according to the invention is preferably suitable for establishing such walls in the case of clutch plate carriers but can naturally also be used for other cup-shaped hollow bodies of this type.

[0014] Furthermore, according to the invention, the object is achieved by a device having an effective surface of the working stamp with a smaller width than the width of the tooth tip. Additional preferred embodiments of the device are described and claimed herein.

[0015] An embodiment of the present invention will be explained in detail in the following by means of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Figure 1 is a perspective view of a hollow body in the form of a clutch plate carrier;

[0017] Figure 2 is a longitudinal sectional view of the clutch plate carrier according to Figure 1;

[0018] Figure 3 is a detailed view of the cutout of a front edge of a tooth tip according to Figure 2;

[0019] Figure 4(a) is a schematic frontal view and longitudinal sectional view of a tooth tip of a hollow body according to Figure 1 before the machining according to the invention;

[0020] Figure 4(b) is a schematic frontal and longitudinal sectional view of the tooth tip of the hollow body according to Figure 4(a) after the machining of the formed wall according to the invention;

[0021] Figure 5(a) is a schematic frontal and longitudinal sectional view corresponding to Figure 4(a) with a preferably constructed striking or stamping tool according to the invention having lateral stop edges;

[0022] Figure 5(b) is a schematic frontal and longitudinal sectional view according to Figure 5(a) with the striking or stamping tool in the end position; and

[0023] Figure 6 is a view of another preferred embodiment of a striking or stamping tool according to the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0024] Figure 1 illustrates a cylindrical hollow body in the form of a clutch plate carrier 1, as it is used in automatic transmissions, for example, for passenger cars. The clutch plate carrier 1 has a toothed profile constructed, so as to extend parallel to its longitudinal axis. The floor of the clutch plate carrier 1 is constructed as an inwardly open flange 2, while the toothed profile ends in an open fashion toward the free face side, as clearly indicated in the longitudinal sectional view according to Figure 2.

[0025] Such clutch plate carriers 1 are conventionally produced by pressing, rolling or striking methods, or combined methods, from a blank directly in the

profiled shape. As a result, the toothed profile along the longitudinal axis has an identical shape. Particularly, the interior and exterior surfaces of the tooth tip and of the tooth base extend parallel to the longitudinal axis.

[0026] A radially inward-directed wall 4 next is established on the interior side 3' of each tooth tip 3, as clearly shown in Figure 3 as a detailed cutout of the longitudinal sectional view according to Figure 2. This wall 4 has the purpose of preventing the oil film formed during operation on the interior side of the clutch plate carrier 1 from moving axially toward the face side, which therefore results in a draining of the oil in this direction. As a result, the wall may also only have very small radial dimensions.

[0027] According to the invention, it is now suggested to form such a wall 4 by using a striking or stamping tool in that a stamp 5 is guided radially from the outside so as to impact the exterior surface 3" of the tooth tip 3.

[0028] According to the invention, this stamp 5 has a width which is smaller than the width b of the tooth tip 3; that is, the stamping process is not carried out over the entire width b of the tooth tip 3 but only over a partial region of this width b.

[0029] As a result, after the stamping process has taken place, as shown in Figure 4(b), a wall 4 is formed, as required, on the interior side 3' of the tooth tip 3. On the exterior side, a small groove or notch 6 is formed by the stamp 5. As a result of the dimensioning of the stamp 5 according to the invention, the edge of the outer surface of the tooth tip 3 is now advantageously not machined or

impaired, so that, after the stamping process has taken place, the tooth profiles 7 also still have their original shape.

[0030] The stamp 5 preferably has a working surface 5' oriented at an acute angle with respect to the exterior surface 3" of the tooth tip 3 in the longitudinal direction of the clutch plate carrier 1, as illustrated particularly as a longitudinal sectional view from Figure 4(a). This advantageously produces a wall 4 with a diagonally rising flank to the interior side of the clutch plate carrier 1. The width of the stamp 5 is preferably selected specifically such that a wall is formed which spans the width of the interior surface of the tooth tip 3 between the two interior tooth profiles.

[0031] Particularly, for thin wall thicknesses of the clutch plate carrier 1 or very wide tooth tips 3, a stamp 8 may advantageously be used as a stamping tool which, in addition to the actual stamping or working surface 8', has holding surfaces 9 projecting laterally away therefrom in the working direction, as illustrated in Figure 5(a). In this case, the working surface 8' and the holding surfaces 9 are advantageously produced in one piece. As an alternative, particularly the working surface 8' could also be produced of a separate material and be detachably or fixedly connected with the basic body of the holding surfaces.

[0032] Such a stamping tool thereby prevents lateral migration or displacement of material of the tooth tip 3, and thereby is used for an optimal maintaining of the shape of the exterior design of the corresponding tooth tip 3 in that these

holding surfaces 9 act as clamps with respect to the stamp 8 and permit only a transporting of material within the tooth tip 3 in the radial direction with respect to the longitudinal axis of the clutch plate carrier 1. Such a tool is particularly suitable, for example, in the case of relatively thin wall thicknesses or wide tooth tips 3.

[0033] Another alternative stamping tool according to the invention is schematically illustrated in a longitudinal sectional view of Figure 6. In this case, the stamp 8, as the stamping tool, and the holding surfaces 9, as the clamp 10, may be separately displaced with respect to one another. Thus, the clamp 10 may first be brought to strike against the tooth tip 3, and only afterwards can the stamp 8 be brought to strike in a stamping manner against the top side of the tooth tip 3.

[0034] Advantageously, the stamping operations are implemented individually for each individual tooth tip 3 sequentially one after the other; that is, the clutch plate holder 1 rotates in each case in steps about its longitudinal axis and carries out the machining at a station.

[0035] As an alternative, it is also contemplated that simultaneously two or more stamping operations are carried out parallel to one another and, in-between, the clutch plate carrier is rotated about the corresponding number of tooth tips 3.

[0036] The drive of the stamping tool takes place in a known manner, for example, either mechanically or hydraulically. A mechanical drive, as a rule, achieves a greater regularity and precision for constructing the walls 4.